

Method of open and / or closed-loop control of the movement of welding tongs

Claims

1. Method of open and / or closed-loop control of a welding tong movement by means of a welding tong drive (1), comprising at least one primary and one secondary drive device (2, 3), wherein the primary drive device (2) moves at least two welding tong limbs (5, 6) with welding electrodes (7, 8) from essentially opposite sides towards a welding object (9) and presses them with a predetermined compressive force onto it and wherein the secondary drive device (3) during its actuation varies a spatial orientation of the welding tongs (4) and in particular of the welding tong limbs (5, 6), with the following steps:
 - a) approach of the welding tongs (4) to a certain spatial point relative to the welding object;
 - b) holding of the welding tongs (4) in a fixed spatial orientation during the approach;
 - c) actuation of the secondary drive device (3) up to the contacting of the welding object (9) with at least one welding tong limb (5, 6) and acquisition of the contacting, and
 - d) closure of the welding tongs (4) by the primary drive device (3) with the build-up of an appropriate welding pressure.
2. Method according to Claim 1, wherein in step (a) the welding tongs (4) are moved by means of a robot device (10).
3. Method according to Claim 1 or 2, wherein the primary and / or secondary drive devices (2, 3) are operated by electric motors.
4. Method according to one of the aforementioned claims, wherein in step (b) the secondary drive device (3) is supplied with current varying in level and direction to retain the welding tongs (4) in a rigid relative position with respect to the robot device (10) or to the welding object (9).
5. Method according to one of the aforementioned claims, wherein after step (b) and before step (c), i.e. after termination of the approach towards the welding object (9), an applied holding current of the secondary drive device (3) is acquired with its arithmetic sign.
6. Method according to Claim 5, wherein in step (c) the holding current is varied by a certain contacting current level for the actuation of the secondary drive device (3) for establishing contact.

7. Method according to Claim 6, wherein the contacting current value is determined experimentally for essentially each spatial point.
8. Method according to one of the aforementioned claims, wherein the contacting current value is selected to be at least sufficiently high to overcome friction forces occurring during the movement of the respective used welding tongs (4).
9. Method according to one of the aforementioned claims, wherein the contacting current value is increased briefly by a specified factor to achieve an initial breakaway torque for initiating the movement of the welding tongs (4) by means of the secondary drive device (3).
10. Method according to Claim 9, wherein the contacting current value is increased for a certain time and / or a certain movement displacement of the secondary drive device (3).
11. Method according to one of the aforementioned claims, wherein the contacting of the at least one welding limb (5, 6) occurs by monitoring the current passed to the secondary drive device (3).
12. Method according to Claim 11, characterised in that the contacting is detected by acquiring a servo lag in the monitored current.
13. Method according to one of the aforementioned claims, wherein the welding pressure in step (d) is increased to a few kN, in particular up to about 5 kN.
14. Method according to one of the aforementioned claims, wherein the welding tong limbs (5, 6) are opened by means of the primary drive device (3) before moving to a further welding point or after termination of welding and then the welding tongs (4) are moved by means of the secondary drive device (3) to a specified starting spatial point.
15. Method according to one of the aforementioned claims, wherein deviations from specified spatial points of the welding object (9) or from the corresponding welding points are acquired by means of the open and / or closed-loop control device (11) of the secondary drive device (3) and / or of the primary drive device (2) and are passed to an evaluation device (12) in particular for quality assurance.
16. Method according to one of the aforementioned claims, wherein bodily changes to the welding electrodes (7, 8) and to parts of the welding electrodes due to wear, degrading of material, loss of a welding electrode or parts thereof or similar effects are acquired on contacting the welding object or contacting the welding tong limbs (5, 6) or the welding electrodes (7, 8) together by means of the open and / or closed-loop control device (11).

17. Method according to Claim 16, wherein the starting spatial point is corrected with regard to the bodily changes and / or the change is passed to the evaluation device (12).
18. Method according to one of the aforementioned claims, wherein the secondary drive device (3) is swivelled by at least two single drives of the welding tongs (4) essentially within a hemisphere.